SPECIFICATION

OPTICAL RECEPTACLE

FIELD OF THE INVENTION

The present invention relates to an optical receptacle which is attached to a printed board and to which an optical plug can be connected, and for example, relates to an optical receptacle which carries an internal optical element which is connected to an optical plug attached to the end of an optical fiber to connect the optical fiber and optical element.

RELATED ART

Conventionally, Plastic Optical Fiber (hereinafter POF) is used to transmit signals quickly and at low costs. As optical connector corresponding to this POF, there is Small Multimedia Interface (hereinafter referred to as SMI) -type optical connector. SMI-type optical connectors such as this are utilized in digital household appliances such as televisions and DVD (Digital Versatile Disc), and the standardization thereof is being implemented.

The SMI-type optical connector comprises, for example, an optical plug and an optical receptacle to which this optical plug is attached. This optical connector has a push/pull fastening structure which is compact and securely locks the optical plug and optical receptacle.

The foregoing optical receptacle has, for example, a two-piece structure of inner-housing to which an optical element is embedded and outer-housing which locks the optical plug (for example, Patent Laid-Open Publication No. 2000-347073).

Specifically, the outer-housing is box-shaped and has a connection edge

to which the optical plug is inserted. Within the outer-housing, an elastic engagement piece is provided in the direction of the connection edge. The optical plug can be fixed to the outer-housing by inserting the optical plug into the connection edge and engaging to the elastic engagement piece.

On the other hand, the inner-housing has an optical element receiving cavity to which the optical element is stored. Here, the optical element has a duplex structure with separate transmission end and receiving end. After optical element is inserted into the optical element receiving cavity of the inner-housing, this inner-housing is inserted into the joint cavity formed within the outer-housing. Then, the relative position of the outer-housing and the inner-housing is stipulated by the three directions which are mutually perpendicular, and the optical element within the inner-housing is positioned in a fixed position within the outer-housing.

Incidentally, the inner-housing is formed from synthetic resin material comprising carbon filler. In addition, ground pins which penetrate the outer-housing are implanted in the inner-housing. These ground pins are soldered to the ground circuit of the printed board which will be the connection body of the optical receptacle.

By connecting inner-housing which has conducting properties to the ground circuit via ground pins in this way, EMI (Electro Magnetic Interference) and electrostatic destruction can be prevented.

Incidentally, because the ground pins are fixed to the printed board by soldering in conventional receptacles, not only does the number of parts increase, but assembly man-hours increase as well. Therefore, an optical receptacle which can be easily attached to a printed board is required.

SUMMARY OF THE INVENTION

The object of the present invention is to provide an optical receptacle which can be easily attached to a printed board to remedy the foregoing issues.

In order to achieve the object above, the inventors of this present invention have invented a new optical receptacle such as that below.

(1) An optical receptacle for being attached to a printed board and to which an optical plug can be connected comprising: a tubular main housing; and a socket housing which is inserted and attached to the main housing; wherein the main housing has an elastic locking part which protrudes from the outer circumference surface and locks onto the printed board; and the socket housing has a locking slotted pin which protrudes from the outer circumference surface and locks onto the printed board.

The optical receptacle is, for example, implemented in Small Multimedia Interface–type optical plugs.

The invention according to (1) differs from instances wherein the optical receptacle is fixed on to a printed board via ground pins such as in conventional receptacles, and rather, has an elastic locking part on the outer circumference surface of the main housing instead of ground pins and has a locking slotted pin on the outer circumference surface of the socket housing.

Therefore, this optical receptacle is attached to a printed board after the two pieces, main housing and socket housing, are assembled. As a result, this optical receptacle has a simple structure because ground pins are not required. Furthermore, this optical receptacle can be easily attached to a printed board because it does not have to be welded onto the printed board with the ground pins.

(2) The optical receptacle according to (1), wherein the main housing comprises a connection opening part to which the optical plug is inserted, and within the main housing comprises an elastic claw which extends towards the

connection opening part; and the elastic claw holds the optical plug within the main housing by engaging with the optical plug inserted from the connection opening.

According to the invention in (2), the optical plug is held within the optical receptacle because the elastic claw engages with this optical plug when the optical plug is inserted into the connection opening part. As a result, the optical plug can be easily attached to the optical receptacle.

(3) The optical receptacle according to (1) or (2), wherein locking holes into which the elastic locking part of the main housing and the locking slotted pin of the socket housing are inserted respectively are formed on the printed board.

According to the invention in (3) the optical receptacle can be attached to and removed from the printed board freely by inserting and removing the elastic locking part and the locking slotted pin from the locking holes without welding the optical receptacle to the printed board with ground pins, such as in conventional receptacles.

(4) The optical receptacle according to any one of (1) to (3), wherein the socket housing is capable of storing optical elements, formed from synthetic resin material containing conductive filler, is electrically conductive between the optical element and the printed board.

According to the invention in (4), EMI and electrostatic destruction of the optical element can be prevented because the optical element can be electrically conducted to the printed board via the socket housing.

(5) The optical receptacle according to (4), wherein the conductive filler is a carbon filler.

(6) The optical receptacle according to any one of (3) to (5), wherein the elastic locking part has a first elastic locking part and a second elastic locking part; and the first elastic locking part and the second elastic locking part,

respectively comprise a main body which protrudes from the main housing and extends linearly, and a locking part which protrudes from the main body which is locked to the locking hole of the printed board; and the locking parts are positioned so as to face each other.

According to the invention in (6), when the first elastic locking part and the second elastic locking part are respectively inserted into the locking holes formed on the printed board, the space between the locking parts expands, the locking parts are pressed against the edges of the locking holes, and the main body is elastically deformed. Then, when the first elastic locking part and the second elastic locking part are completely inserted into the locking holes, the locking part is locked onto the locking hole by the elastic restorative force of the main body. Therefore, the main housing is prevented from easily separating from the printed board.

(7) The optical receptacle according to any one of (3) to (5), wherein the elastic locking part has a first elastic locking part and a second elastic locking part; and the first elastic locking part and the second elastic locking part respectively comprise a main body which protrudes from the main housing and extends linearly, and a locking part which protrudes from the main body and is locked to the locking hole of the printed board; and the locking parts are positioned facing in the opposite direction of each other.

According to the invention in (7), when the first elastic locking part and the second elastic locking part are respectively inserted into the locking holes formed on the printed board, the locking parts are pressed against the edges of the locking holes, the space between the locking parts narrows, and the main body is elastically deformed. Then, when the first elastic locking part and the second elastic locking part are completely inserted into the locking holes, the locking part is locked onto the locking hole by the elastic restorative force of the

main body. Therefore, the main housing is prevented from easily fall off from the printed board.

(8) The optical receptacle in (5) or (6), comprising a plural of the elastic locking parts, and the direction in which the plurality of first elastic locking parts are aligned and the direction in which the plurality of second elastic locking parts are aligned in parallel.

According to the invention in (8), the position of the optical receptacle to the printed board can be held in a more stable state.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an exploded perspective view showing the structure of an optical receptacle according to this embodiment.

Fig. 2A is a front elevational view of the main housing according to this embodiment.

Fig. 2B is a left-side view of the main housing of the embodiment.

Fig. 2C is a cross-sectional view in the X-X direction in Fig. 2B.

Fig. 2D is a right-side view of the main housing of the embodiment.

Fig. 3A is a front elevational view of the socket housing of the embodiment.

Fig. 3B is a right-side view of the socket housing of the embodiment.

Fig. 3C is a bottom view of the socket housing of the embodiment.

Fig. 4 is a top view of the printed board to which the optical receptacle is attached to the embodiment.

Fig. 5A is a top view of the optical receptacle of the embodiment.

Fig. 5B is a front elevational view of the optical receptacle of the embodiment.

Fig. 5C is a right-side view of the optical receptacle of the embodiment.

Fig. 5D is a left-side view of the optical receptacle of the embodiment.

Fig. 6A is a cross-sectional diagram in the B-B direction in Fig. 5A.

Fig. 6B is a cross-sectional diagram in the A-A direction in Fig. 5A.

Fig. 7A is a partially enlarged front elevational view of the optical receptacle of the second embodiment

Fig. 7B is a partially enlarged front elevational view of the optical receptacle of the second embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Each embodiment of the present invention is described below based on the drawings. In the description of the embodiments below, the same reference numbers are affixed to the same construction requisite and explanations therefor are omitted or simplified.

[First Embodiment]

Fig. 1 is an exploded perspective view showing the structure of an optical receptacle 10 according to this embodiment.

In this embodiment, an optical receptacle 10 is attached to a printed board and an SMI-type optical plug for POF is connected thereto.

The optical receptacle 10 comprises a main housing 2 and a socket housing 3 which is inserted into and attached to this main housing 2.

Fig. 2A is a front elevational view of the main housing 2 according to this embodiment; Fig. 2B is a left-side view of the main housing 2; Fig. 2C is a cross-sectional view in the X-X direction in Fig. 2B; and Fig. 2D is a right-side view of the main housing 2.

The main housing 2 is tubular. A connection opening part 20 to which an optical plug 1 is inserted is formed on one end, and a joint opening part 23 to which the socket housing 3 is inserted is formed on the other end.

Within the main housing 2, a partition 24 is formed to divide the connection opening part 20-side and the joint opening part 23-side. A pair of cylindrical cylinder convex parts 25 is formed on the partition 24 to protrude towards the connection opening part 20-side.

A photoconductive entrance path 25A is formed on the inner circumference surface of the pair of cylinder convex parts 25, and when the main housing 2 and the socket housing 3 are assembled, a received luminous element 4 (Fig. 1), described hereafter, passes through photoconductive entrance path 25A and transmits and receives optical signals.

In addition, as shown in Fig. 2C, an elastic claw 21 which extends towards the connection opening part 20 is formed in a cantilevered beam-shape on the partition 24. This elastic claw 21 holds the optical plug 1 within the main housing 2 by locking onto the optical plug 1 which is inserted into the connection opening part 20. In other words, the optical plug 1 and the optical receptacle have a push/pull fastening structure.

Furthermore, on the outer circumference surface of the main housing 2, as shown in Fig. 2A and Fig. 2C, rectangular locking small holes 23A and 23B which penetrate to the joint opening part 23-side within the internal space of the main housing 2 are formed. A pair of locking small projection 35A and 35B (Fig. 3C), described hereafter, are inserted into these locking small holes 23A and 23B from the interior of the main housing 2.

As shown in Fig, 2B and Fig. 2D, the main housing 2 has plural elastic locking parts 27A and 27 B which protrudes from the outer circumference surface (undersurface) and locks onto a printed board 5 (Fig. 4), described hereafter.

The elastic locking part 27A comprises a first locking part 26A and a second locking part 26B. The elastic locking part 27B comprises a first locking

part 26C and a second locking part 26D.

The direction in which the plural first elastic locking parts 26A and 26C are aligned and the direction in which the plural second locking parts 26B and 26D are aligned are parallel.

The first elastic locking part 26A and 26C and the second elastic locking part 26B and 26D each comprise a main body 261 which protrudes from the main housing 2 and extends linearly and a locking part 262 which protrudes from this main body 261 and is locked onto square holes 5A and 5B (Fig. 4), described hereafter, of the printed board. The locking part 262 of the first elastic locking part 26A and 26C and the locking part 262 of the second elastic locking part 26B and 26D are positioned facing each other.

Fig. 3A is a front elevational view of the socket housing 3; Fig. 3B is a right-side view of the socket housing 3; and the Fig. 3C is a bottom view of the socket housing 3.

Socket housing 3 has a received luminous element 4 as the optical element (refer to Fig. 1). Here, the received luminous element 4 is a photoelectric element of integrated light receiving element (photo transistor) and luminous element (light-emitting diode).

Socket housing 3 is a molded object formed from synthetic resin material containing conductive filler, or more specifically, carbon filler, and as shown in Fig. 3A, has outer walls formed into a rough rectangular shape by upper wall 31, lower wall 32, right wall 33, and left wall 34. The outer walls of the socket housing 3 are in close contact to the inner circumference surface of the joint opening part 23 -side of the main housing 2 when socket housing 3 is inserted into the main housing 2.

A locking small projection 35A which has a triangular cross-section is formed to protrude from the right wall 33. Similarly, a locking small projection

35B which has a triangular cross-section is formed to protrude from the left wall 34. According to these locking small projections 35A and 35B, when socket housing 3 is inserted into the joint opening part 23 of the main housing 2, the slanted sections of the locking small projections 35A and 35B press open the inner circumference surface of the main housing 2. Subsequently, when the socket housing 3 is completely placed within the main housing 2, the locking small projections 35A and 35B are locked onto locking small holes 23A and 23B, the inner circumference surface of the joint opening part 23 which has been pressed open returns to is original state, and the socket housing 3 is held within the main housing 2.

As shown in Fig. 3A and Fig. 3C, a pair of element attachment grooves 36 is formed within the socket housing 3. Prior to attaching the socket housing 3 to the main housing 2, two received luminous elements 4 are fixed by adhesive to the element attachment grooves 36.

The socket housing 3 has a locking slotted pin 37 which protrudes from the outer circumference surface (bottom surface) and locks onto round hole 5E (Fig. 4) of the printed board 5, described hereafter.

Fig. 4 is a top view of the printed board 5 to which the optical receptacle 10 is attached.

Square holes 5A and 5B as locking holes to which the first elastic locking part 26A and 26B are locked, square holes 5C and 5D as locking holes to which the second elastic locking part 26C and 26D are locked, round hole 5E as a locking hole to which the locking slotted pin 37 is locked, and terminal hole 41 to which the lead terminal of the received luminous element is mounted are formed on the printed board 5.

The round hole 5E and terminal hole 41 are through-holes. The round hole 5E has an inner diameter which is slightly smaller than the outer diameter of

the locking slotted pin 37 and is connected to the ground pattern formed on the printed board 5.

If the space between the inner edge of the square hole 5A and the inner edge of the square hole 5B (or, the inner edge of the square hole 5C and the inner edge of the square hole 5D) is L1 and the space between the inner edge of the elastic locking part 26A and the inner edge of the elastic locking part 26B (or, the space between the inner edge of the elastic locking part 26C and the inner edge of the elastic locking part 26D) is L3 (refer to Fig. 2B), L1 > L3.

If the space between the outer edge of the square hole 5A and the outer edge of the square hole 5B (or, the outer edge of the square hole 5C and the outer edge of the square hole 5D) is L2 and the space between the outer edge of the elastic locking part 26A and the outer edge of the elastic locking part 26B (or, the space between the outer edge of the elastic locking part 26C and the outer edge of the elastic locking part 26D) is L4 (refer to Fig. 2B), L2 > L4.

Next, the procedure for assembling the optical receptacle according to the present invention is explained based on the drawings.

Fig. 5A is a top view of the optical receptacle 10; Fig. 5B is a front elevational view of the optical receptacle 10; Fig. 5C is a right-side view of the optical receptacle 10; and Fig. 5D is a left-side view of the optical receptacle 10.

In addition, Fig. 6A is a cross-sectional diagram in the B-B direction in Fig. 5A, and Fig. 6B is a cross-sectional diagram in the A-A direction in Fig. 5A.

First, as shown in Fig. 6A and Fig. 6B, the optical receptacle 10 is assembled by attaching received luminous element 4 to socket housing 3 and inserting this socket housing 3 into the main housing 2.

Subsequently, this optical receptacle 10 is attached to the printed board 5. More particularly, the elastic locking parts 26A to 26D are inserted into square holes 5A to 5D. Then, the locking parts of the elastic locking parts 26A

to 26D are pressed against the edges of the square holes 5A to 5D, the spaces between the locking parts expand, and the main bodies of the elastic locking parts 26A to 26D become elastically deformed. Then, after the elastic locking parts 26A to 26D are completely inserted into square holes 5A to 5D, the locking parts are locked onto the square holes 5A to 5D due to the elastic restorative force of the main body. Therefore, the main housing 2 can be prevented from easily separating from the printed board 5.

At the same time, the locking slotted pin 37 is inserted into the round hole 5E. Then, the locking slotted pin 37 is pressed against the edges of the round hole 5E and becomes elastically deformed, and the outer diameter becomes small. Subsequently, after the locking slotted pin 37 is completely inserted into the round hole 5E, the locking slotted pin 37 biases the edges of the round hole 5E due to elastic restorative force, and the socket housing 3 is held to the printed board 5 by the frictional force with round hole 5E.

Through this, the locking slotted pin 37 of the socket housing 3 is connected to the ground pattern formed on the printed board 5, the received luminous element 4 and printed board 5 become electrically conductive, and EMI and electrostatic destruction of the received luminous element 4 can be prevented.

[Second Embodiment]

In this embodiment, the attachment structure of the optical receptacle 10 differs from the first embodiment.

Fig. 7A is a partially enlarged front elevational view of the optical receptacle 10A, and Fig. 7B is a partially enlarged front elevational view of the optical receptacle 10A.

In this embodiment, the locking parts of the first elastic locking parts 26A and 26C and the second elastic locking parts 26B and 26D respectively

comprise a main body and a locking part which protrudes from the main body. The locking parts of the first elastic locking parts 26A and 26C and the locking parts of the second elastic locking parts 26B and 26D are positioned facing in the opposite direction of each other.

In other words, if the space between the inner edge of the elastic locking part 26A and the inner edge of the elastic locking part 26B (or, the inner edge of the elastic locking part 26C and the inner edge of the elastic locking part 26D) is L5, L5 > L1.

If the space between the outer edge of the elastic locking part 26A and the outer edge of the elastic locking part 26B (or, the outer edge of the elastic locking part 26C and the outer edge of the elastic locking part 26D) is L6, L6 > L2.

In this embodiment, when attaching this optical receptacle 10 to the printed boars 5, the elastic locking parts 26A to 26D are inserted into the square holes 5A to 5D. Then, the locking parts of the elastic locking parts 26A to 26D are presses against the edges of the square holes 5A to 5D, the spaces between the locking parts become narrow, and the main body of the elastic locking part 26A to 26D become elastically deformed. Then, after the elastic locking parts 26A to 26D are completely inserted into the square holes 5A to 5D, the locking parts lock onto the square holes 5A to 5D due to the elastic restorative force of the main body. Therefore, the main housing 2 can be prevented from easily separating from the printed board 5.

According to the present invention, the effects are such as that below.

Unlike instances wherein the optical receptacle is fixed on to a printed board via ground pins such as in conventional receptacles, an elastic locking part is provided on the outer circumference surface of the main housing instead of ground pins and a locking slotted pin is provided on the outer circumference

surface of the socket housing.

Therefore, this optical receptacle is attached to a printed board after the two pieces, the main housing and the socket housing, are assembled. As a result, the construction of the optical receptacle can be simplified because ground pins become unnecessary. Additionally, this optical receptacle can be easily attached to a printed board because it does not have to be welded onto the printed board with the ground pins.